

REMARKS

Claims 1, 6, 7, 10, 13-16 and 18-19, 23-25, 28-29, 32 and 35-38 are pending.

I. Claim Amendments

Claim 1 was amended to recite the subject matter of (now cancelled) claim 34.

Claim 1 was also amended to recite the part being manufactured is an aeronautical member as supported at page 1 paragraph [003].

Claims 28, 33 and 34 were cancelled consistent with the combination of Claims 1 and 34. New Claim 35 recites the aeronautical member is a structural part of an aircraft as supported at page 1 paragraph [003].

Claim 36 recites the structural part of an aircraft comprises stringers and skin, wherein the stringers are integrally connected to the skin as supported at page 1, paragraph [0023].

The language from Claim 1, that machining the shaped structure obtains an integrated monolithic aluminum structure for part of a wing skin or a frame portion for an aircraft, has been moved to new Claim 37.

Claim 38 recites artificially ageing the shaped structure and then machining the aged shaped structure as disclosed at page 4, paragraph [0018].

It is respectfully submitted the Amendment does not add new matter.

II. 35 USC §103(a)

A. Claims 1, 6, 7, 10, 13-16, 18, 19, 23-25, 28, 29 and 32-34

Claims 1, 6, 7, 10, 13-16, 18, 19, 23-25, 28, 29 and 32-34 stand rejected under 35 USC §103(a) as being unpatentable over AAPA (which the Examiner considers "Applicant's Admitted Prior Art" disclosed by Applicant's specification at pages 1-3) in view of Bruner et al. (US Patent 3,568,491), Liu et al. (US 5,108,520) and Chakrabarti et al. (US2002/0150498).

Claim 1 recites artificially aging a bent structure. The present invention's artificial ageing after bending is in addition to other ageing that may have occurred before bending.

The Office Action asserts the alleged AAPA discloses a method for producing an integrated monolithic aluminum structure for a part of a wing skin or frame structure for an aircraft wherein an aluminum plate with a thickness in the range of 15 to 75 mm is bent to form a predetermined shaped and, after the bending operation, the plate is machined to produce the

monolithic structure. It appears the Office action is pointing to Paragraphs [004] - [009], more specifically the method described at Paragraph [008], of the originally filed specification.

The Office action agrees the AAPA does not disclose heat treating the shaped structure comprising artificially ageing the shaped structure to a T6, T79, T78, T77, T76, T74, T73 or T8 temper prior to machining. Thus, to make up for this deficiency the Office action asserts Bruner et al. It is respectfully submitted Bruner et al. does not make up for the deficiencies of the AAPA.

1. Amended claim 1 recites manufacturing an aeronautical part

As stated in the application at paragraph [009], the bending and the machining of aeronautical parts results in considerable distortion. Paragraph [009] also explains this bent and machined structure comprising sheet and stringers or beams displays residual or inner stress originating from such bending, which results in regions with less and more internal stress. The regions with more internal stress tend to be considerably more susceptible to corrosion and fatigue crack propagation. As further explained in paragraph [0043] on page 9, "A disadvantage of this approach is that there may be significant residual stress in the product, and this may lead amongst others to increasing the cross-section of frame members or the skin itself to meet required tolerances and safety requirements."

It is respectfully submitted the problems arising in the manufacturing of aeronautical parts are not obvious from the other areas of application of aluminum alloys, because of the extreme conditions under which the aeronautical parts operate. The aeronautical parts having bent structures and especially aircraft parts having skin and stringers connected thereto have to comply with more stringent requirements than most manufacturing parts in other areas. Therefore, the problems arising in the aeronautical area are either not recognized in other areas or do not play such an important role as in the aeronautical area.

In the manufacture of aeronautical parts, distortions are a crucial characteristic of any parts used in the aircraft. With the present invention it is possible to manufacture aircraft parts having stringers connected to the skin in one step without the necessity of welding the stringers to the skin which would generate additional internal stress and create regions of different microstructure.

2. Bruner et al. would not lead one skilled in the art to apply it to modify the AAPA to bend during cold forming

Amended method Claim 1 recites its cold forming comprises bending to form the shaped structure having a built-in radius. Thus, the present claims recite bending during cold forming.

In contrast, it is respectfully submitted Bruner et al. does not disclose bending. It is respectfully submitted, Figs. 2-5 of Bruner et al. show the workpiece 10 is not curved by hot forming or cold forming. Even if the curved side of Bruner et al. is assumed to be a bend, the curve is formed before or during hot forming. Thus, the curve is not formed by cold forming.

Bruner et al. requires manufacturing a stress-relieved aluminum alloy forging using the same die for both hot forming and cold forming (See Bruner et al. Abstract). Both the hot forming and cold forming shape the forging to its final configuration (See Bruner et al. Summary of the Invention, as well as col. 3, line 72-col. 4, line 1). There is no bending during Bruner et al.'s cold forming to form the shaped structure since the workpiece is in its final configuration prior to cold forming.

Furthermore, the present invention solves a problem of the AAPA caused by bending. In particular, the disadvantages of the AAPA result from bending an alloy plate for the manufacturing of aircraft parts. In contrast, Bruner et al. solves a problem caused by forging. Thus, the motivation of Bruner et al. is irrelevant to the AAPA. Thus, one skilled in the art would not consider Brunner et al., because Bruner et al. is silent with regard to bending an alloy plate to obtain parts which have to comply with very stringent requirements.

3. Claims 35-37

Claims 35-37 further distinguish over the references. Bruner, col. 3, lines 43-45 mentions "aircraft structural forging" and col. 4, last paragraph before the claims, mentions aircraft-quality stress relieved forgings. However, Brunner et al. is silent with regard to the structural parts of an aircraft such as fuselage. Claim 35 recites the method of manufacturing structural parts of an aircraft. Claim 36 recites the structural parts comprise stringers and skin, wherein the stringers are connected to the skin. As mentioned above, the aeronautical parts having bent structures and especially aircraft parts having skin and stringers connected thereto have to comply with more stringent requirements than most manufacturing parts in other areas. Claim 37 recites machining the shaped structure obtains an integrated monolithic aluminum structure for part of a wing skin or a frame portion for an aircraft

4. Liu et al. and Chakrabarti et al.

Liu et al. at page 3 of the Office action was cited for composition of 7xxx-series of

aluminum alloys. Chakrabarti et al. at page 4 of the Office action was cited for disclosing properties of various tempers. Neither of these references makes up for the above-discussed deficiencies of the combination of AAPA and Bruner et al.

5. Data shows the present invention method achieves unexpected advantages

The AAPA discloses two methods of prior art processing.

In a first method, the product is bent and stringers or beams are attached as discussed in paragraph [007]. As explained at pages 2-3, paragraph [009], the resulting product from this method has the disadvantage that it displays considerable distortion after the bending and machining operation which makes the assembly of the aircraft fuselage or aircraft wing cumbersome. As explained at page 8, paragraph [0042], "When the additional components 2 are attached to the base sheet 1 and when the whole structure is finished after the machining and riveting or welding step, a horizontal distortion d_1 and/or vertical distortion d_2 usually results from stress relief from the pre-curved plate or sheet which has been bent before additional components 2 are connected to the base sheet or before components 2 are machined from a plate product with a corresponding thickness." This stress relief is not aging.

Stress relieving is different from aging because stress relieving involves heating a product for a short time period at low temperatures. Aging takes longer and is done in a controlled manner to achieve desired strength and corrosion resistance. In particular, artificial aging is performed at higher temperatures than the stress relieving mentioned for the first method of the AAPA.

In a second method disclosed in paragraph [007], a plate is heat treated and then bent and then a portion of the heat treated and bent plate is machined away to form stringers and ribs and beams. The second method appears to be the method relied upon by the Office action. As explained by paragraph [009] this bent and machined structure comprising sheet and stringers or beams displays residual or inner stress originating from such bending operation and results in regions with less or more internal stress. Those regions with an elevated level of internal stress tend to be more considerably susceptible to corrosion and fatigue crack propagation. As further explained at page 9, paragraph [0043], "A disadvantage with this approach is that there may be significant residual stress in the product, and this may lead amongst others to increasing the cross-section of frame members or the skin itself to meet required tolerances and safety requirements." As shown in the below-discussed example, the bent plate prior to machining

suffers from distortion and residual stress. It is respectfully submitted that, after machining the bent plate to the desired shape, the residual stress remains.

Thus, the product of the first method suffers from distortion. Moreover, the product of the second method initially suffers from distortion and residual stress and, even after machining, suffers from residual stress. In contrast, the presently claimed product simultaneously avoids distortion and residual stress.

The significant reduction in distortion after machining while using the method according to the present claims is illustrated by the Example of the present specification. In particular, data at pages 9 and 10 of the present application shows the unexpected advantages of the present invention by comparing the following:

a product of the present invention, namely a plate in a T451 temper bent to a structure with a 1000 mm radius followed by artificial ageing to a T351 temper; with

a comparative product, namely a plate in the T351 temper bent to a structure with a 1000 mm radius and not further aged.

This comparative product is representative of a product processed according to the second prior art method, but not yet machined. The machining would not remove residual stresses in the metal remaining after machining.

The comparative product is also representative of a product processed according to the first prior art method because the distortion caused by bending a plate would also arise in the first prior art method which includes a plate bending step.

The data at paragraph [0048] shows the comparative example has a longitudinal distortion of 0.15 to 0.22 mm which can be calculated to a residual stress in the longitudinal direction of 49 to 54 MPa. In contrast, the distortion in the product of the present invention has a longitudinal distortion of 0.07 to 0.09 mm which can be calculated to a residual stress in the longitudinal direction of 16 to 22 MPa. This is unexpectedly lower.

The invention as currently claimed provides a method which involves two distinct heat treatments, one heat treatment carried out prior to shaping, the shaping includes bending, and a second heat treatment after shaping. The integrated monolithic aluminum structure is machined from the shaped structure.

The presently claimed invention also has various significant advantages not suggested by the alleged AAPA. As explained by the present specification at page 8, lines 8-19, an advantage

of the present invention is that it uses less aluminum for machining or milling since the predetermined thickness "y" of the alloy plate 4 is considerably smaller than a predetermined thickness of the whole aluminum block. Furthermore, by an ageing step after the shaping, it is possible to obtain essentially distortion-free structural members suitable for, e.g., aircraft fuselage and wing applications. Another advantage of the method and the product of the present invention is that it provides a thinner final monolithic product or structure that has strength and weight advantages over thicker type products produced over conventional methods. This means that designs with thinner walls and less weight may be provided and approved for use. Yet another advantage of the method and the product of the present invention is the weight reduction of the monolithic part. Weight is further reduced also by the possible elimination of fasteners. This is related to the accuracy advantages in the machining operation resulting from the reduced distortion, and the inherent accuracy of final machining after forming.

III. Conclusion

In view of the above it is respectfully submitted that all objections and rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Please charge any underpayment for the concurrently filed Amendment, Notice of Appeal or Petition for Extension of Time, or credit any overpayment, to Deposit Account No. 19-4375.

Respectfully submitted,
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